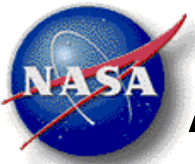


# Agents for Distributed Team Operations

Demonstration

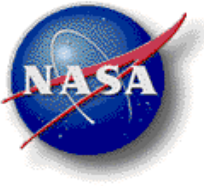
September 2003



# Agents for Distributed Team Operations

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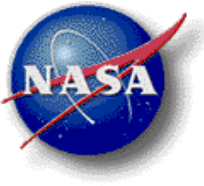
- **Objective:** Demonstrate the use of heterogeneous agents to support manned space operations
- **Approach:** Integrate agents from existing HCC projects in a representative operational scenario
  - **Information Management Agents:** create, update and distribute operational artifacts (HCAAST Project)
  - **Liaison Agents:** notify the user of important events based on user location & role, and manage the user's schedule (DCI Project)
  - **Autonomous Control Agents:** reduce operational workload by automating routine operations (HCAAST, DCI)
- **Sponsor:** M. Shafto, Intelligent Systems Program
- **Project Coordination:**
  - ADTO: Charles Pitman, Lui Wang
  - HCAAST/SMART: Jane Malin, Kathy Johnson
  - DCI: Debra Schreckenghost,
- **Technical Staff**
  - ADTO: Bob Phillips, Mark Guarra
  - HCAAST: Arthur Molin, Pat Oliver,
  - DCI: Pete Bonasso, Richard Day , Cheryl Martin, Tod Milam



# HCAAST Project

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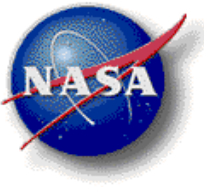
- **Objective:** Assist humans in managing information and communication in support of both nominal and off-nominal operations
- **Approach:** Provide agents working with teamwork tool suite to support distributed teams
  - **Provide information management agents for each flight control discipline**
    - HCAAST Information Managements Agents are called Intelligent Briefing and Response Assistant (IBRA) Agents
    - An IBRA agent serves a flight discipline by monitoring for important events and taking actions when these events occur (e.g., log, report)
  - **Develop web-based support tools used by both humans & agents**
    - WorkIT: manages actions and documents in workspace associated with situation
    - Logger: stores notices and events In a database
    - ReportMaker: builds reports based on logged entries
- **Sponsor:** M. Shafto, Intelligent Systems Program
- **Principal Investigator:** Jane Malin



# SMART Project

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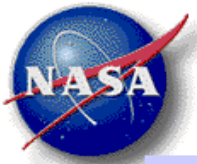
- **Objective:** Assist Flight Surgeons in managing information during flight operations
- **Approach:**
  - Develop a prototype of next generation human centered intelligent flight surgeon console; collaboration with HCAAST project includes
    - WorkIT
    - Logger
  - Develop a methodology for providing systematic principles, guidelines, and procedures for the design of highly-efficient distributed human-computer systems
    - *HCDID* – Human Centered Distributed Information Design
- **Sponsor:** M. Shafto, Intelligent Systems Program
- **Principal Investigator:** Jiajie Zhang



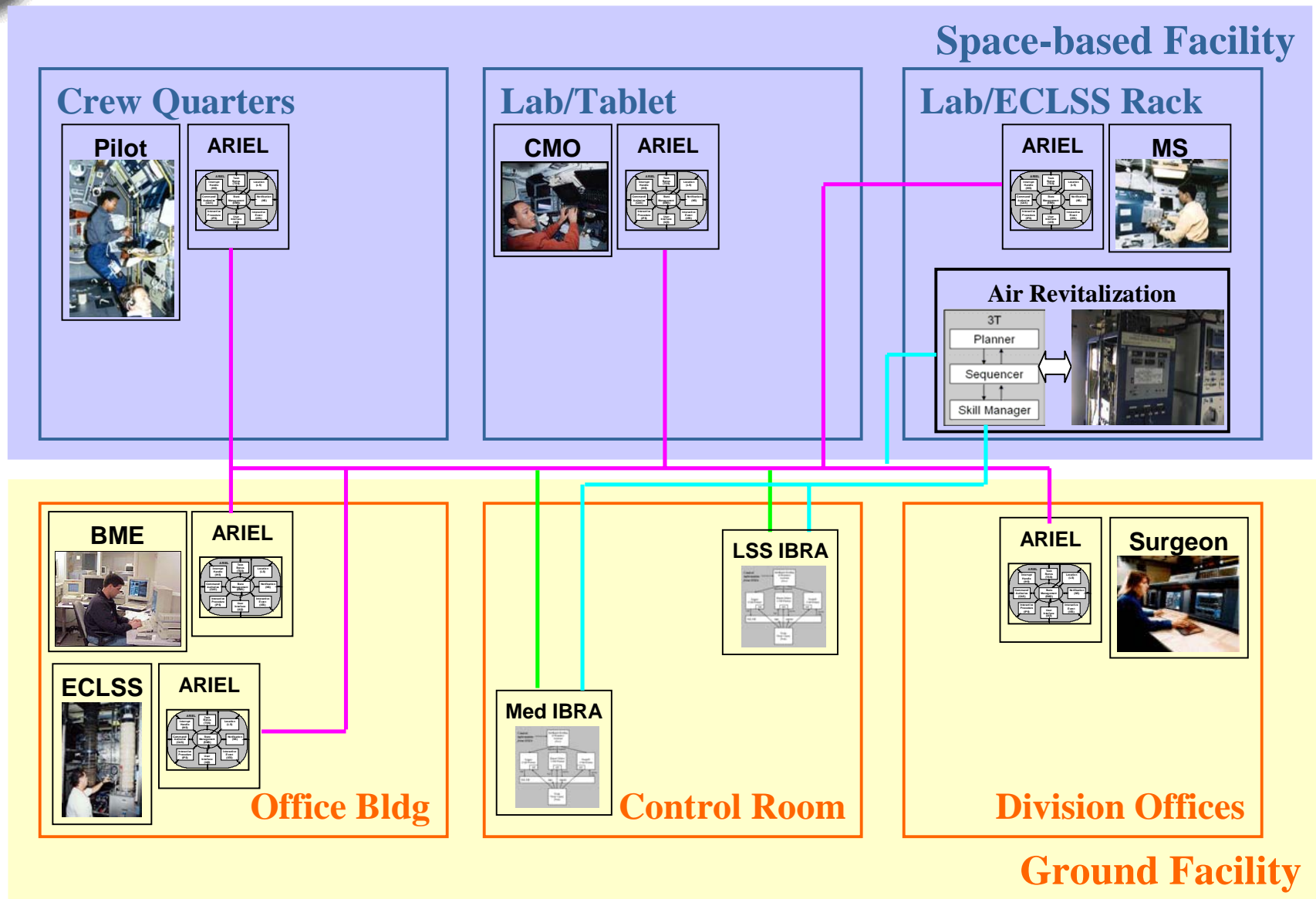
# DCI Project

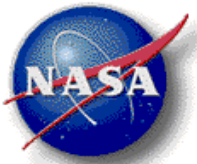
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- **Objective:** Aid users in working with **Automated Control Agents** and with **Other People** to perform tasks for assigned operational roles
- **Approach:** Provide Distributed Collaboration and Interaction (DCI) Environment to facilitate interaction within human-agent group
  - **Personal *liaison* agents for each human in organization**
    - DCI Liaison Agents are called Attentive Remote Interaction and Execution Liaison (ARIEL) Agents
    - An ARIEL agent serves a single user by providing services to help achieve group goals according to group policies and protocols
  - **Key Features of DCI**
    - Event Notification based on user role and location
    - Task Management with automatic schedule updates
    - Location Tracking
    - Situation Summarization
    - Command Authorization
- **Sponsor:** M. Shafto, Intelligent Systems Program
- **Principal Investigator:** D. Schreckenghost



# Agents for Distributed Team Operations





# Human Team in Demo

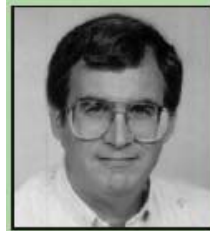
## Crew

Crew Med  
Officer (CMO)



Tod

Mission  
Specialist (MS1)



Pete

Commander



Dave

## Ground Medical

BioMedical  
Engr (BME)



Arthur

Flight  
Surgeon



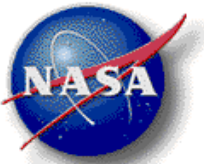
Cheryl

## Ground Life Support

ECLSS  
Controller



Pat



# Demonstration Scenario

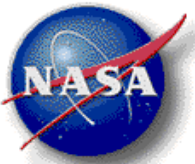
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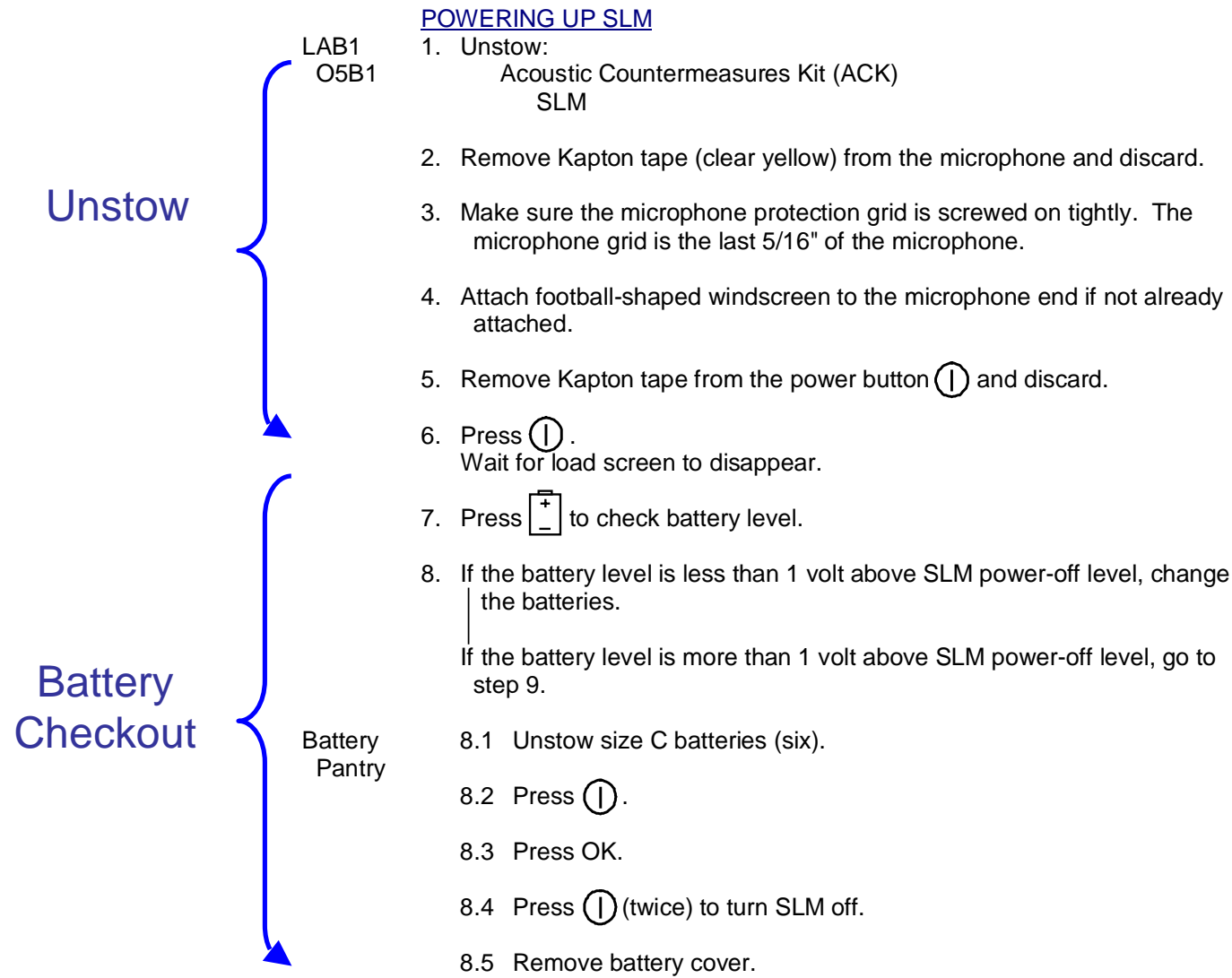
*Nominal Ops:* Crew and ground are aided by their agents in performing routine, periodic checking of life support systems (under autonomous control) and medical equipment

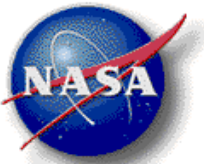
- II. *Anticipated Off-nominal Medical Ops:* Problem of inhalation injury to a crew member, leading to compromised lung function. Agents assist crew and ground coordination to assess and resolve the problem, using established procedures.
- III. *Anticipated Off-nominal Ops:* Problem arises in CO<sub>2</sub> removal system with potential crew impacts and/or degraded performance. Control agent performs routine fault management and support agents help humans in resolving problem.
- IV. *Unanticipated Off-Nominal Ops:* Events II and III interact to create a new problem. Rising CO<sub>2</sub> combined with compromised lung function requires novel problem solving by Flight Surgeon assisted by agents.





# SLM Procedure – Power Up Task

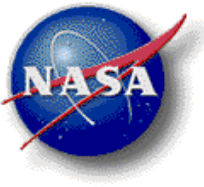




# Demonstration Scenario

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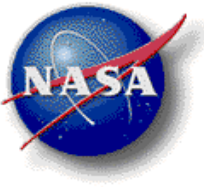
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- ➔ *Anticipated Off-nominal Medical Ops*: Problem of inhalation injury to a crew member, leading to compromised lung function. Agents assist crew and ground coordination to assess and resolve the problem, using established procedures.
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# Demonstration Scenario

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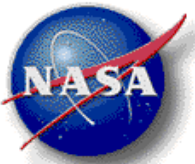
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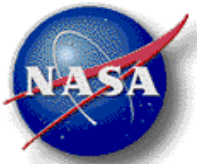
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# OPS Concept Demonstrated

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- **Supervisory monitoring**
  - Departing from vigilant monitoring by humans requires ability to
    - Focus users attention when something important happens
    - Provide remote access to summaries of events after they occur
  - *Approach: use ARIEL notification to draw users attention to events and notices provided by web-based Team Work Center*
- **Humans and agents working together**
  - Human-agent teams must reason about the same information
  - *Approach: provide information management tools that can be manipulated by both humans and software agents*
- **Team coordination based on centralized activity management**
  - Ensure duties are accomplished and schedules are revised in face of contingencies, human unavailability, failures, flight rules changes, etc.
  - *Approach: provide centralized planning of user schedules in DCI, activity tracking within ARIEL agent, and procedure support*
- **Team coordination based on awareness of others**
  - Distributing operations requires support for coordinating actions with other team members
  - *Approach: make roles, activities, and location of other team members visible within ARIEL agent*



# Requirements: Human Support Agents

